

State of Hawaii

Department of Health
Clean Air Branch
Honolulu, Hawaii

2001 Annual Summary Hawaii Air Quality Data



2001 HAWAII AIR QUALITY DATA

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Section 1

INTRODUCTION

The Department of Health has been monitoring ambient air quality in the State of Hawaii since 1957. Until 1971, there was only one air monitoring site, which was located on the island of Oahu. The number of stations in the state's ambient air monitoring network varies according to the current needs and requirements. Today there are a total of 16 stations; 9 on Oahu, 1 on Kauai, 2 on Maui and 4 on Hawaii. The primary purpose of the statewide monitoring network is to measure ambient air concentrations of the six criteria pollutants that the United States Environmental Protection Agency (EPA) has promulgated National Ambient Air Quality Standards (NAAQS). The six criteria pollutants with NAAQS are: carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, ozone, and particulate matter less than or equal to 10 micrometers (PM₁₀). The State of Hawaii also has standards for carbon monoxide and nitrogen dioxide more stringent than the NAAQS and an ambient air standard for hydrogen sulfide.

Ambient air monitoring for lead was discontinued in October 1997 with EPA approval. Since sampling for lead began, levels in the state have been far below the federal standard, and with the elimination of lead in gasoline, measured levels were consistently zero or nearly zero. Also, in September 2001, the state's ozone standard was revised from a one-hour 100 µg/m³ to an eight-hour 157 µg/m³ standard to reflect the latest health studies and to be consistent with the new federal eight-hour ozone standard.

Most commercial, industrial and transportation activities and their associated air quality effects occur on Oahu where nine of the stations are located. Agricultural operations produce the greatest air quality impacts on Maui and Kauai. Impacts on ambient air quality from the ongoing eruption of the Kilauea Volcano and from activities associated with geothermal energy production are being monitored on the island of Hawaii. Current plans call for the continuation of sampling at these sites, however, relocations, additions and/or discontinuations can occur in the future as the need arises.

This report summarizes the validated air pollutant data collected at the 16 monitoring stations during calendar year 2001. Tabular and graphic summaries are provided which compare the measured concentrations with federal ambient air quality standards. In addition, air pollutant concentration trend summaries are depicted in graphic form.

A recent addition to the Department of Health's web site is a display of daily air quality data from specific monitoring stations. The data is posted approximately 3 hours after collection and updated throughout the day. None of the data has been reviewed for quality assurance and is subject to change but provides the public with viewing access to air pollutant and meteorological information from various stations statewide.

To view the daily air quality data on the internet, go to:

www.state.hi.us/doh/air-quality

This entire book can also be viewed online at: www.state.hi.us/doh/eh/cab/index.htm

Questions regarding these data and other air quality data should be addressed to:

Clean Air Branch
State Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378
Phone: 808-586-4200; Fax: 808-586-4359

Section 2

DEFINITIONS

“Ambient Air”: The general outdoor atmosphere, external to buildings, to which the general public has access.

“Ambient Air Quality”: The quality or state of purity of the ambient air.

“Ambient Air Quality Standard”: A limit in the quantity and exposure to pollutants dispersed or suspended in the ambient air.

“Carbon Monoxide”: Carbon monoxide (CO) is a colorless, odorless, tasteless gas under atmospheric conditions. It is produced by the incomplete combustion of carbon fuels with the majority of emissions coming from transportation sources.

“Collocated”: Procedure required for a certain percentage of PM₁₀ samplers in the monitoring network. Collocated samplers determine precision or variation in the PM₁₀ concentration measurements of identical samplers run in the same location under the same sampling conditions.

“EPA”: The United States Environmental Protection Agency.

“Hydrogen Sulfide”: Hydrogen sulfide (H₂S) is a toxic, colorless gas with a characteristic “rotten egg” odor detectable at very low levels. Also known as sewer gas, it is naturally occurring from sources such as volcanic activity, petroleum exploration and bacterial decomposition of organic matter.

“NAAQS”: National Ambient Air Quality Standards. These are pollutant standards that the EPA has established to protect public health and welfare. NAAQS have been set for carbon monoxide, nitrogen dioxide, PM₁₀, ozone, sulfur dioxide, and lead. These are commonly referred to as the six criteria pollutants.

“NAMS”: National Air Monitoring Stations. Sites which are part of the SLAMS network, must meet more stringent siting requirements, equipment type and quality assurance criteria.

- “Nitrogen Dioxide”: Nitrogen dioxide (NO_2) is a brownish, highly corrosive gas with a pungent odor. It is formed in the atmosphere from emissions of nitrogen oxides (NO_x). Sources of nitrogen oxides include electric utilities, industrial boilers, motor vehicle exhaust and combustion of fossil fuels. NO_2 is also a component in the atmospheric reaction that produces ground-level ozone.
- “Ozone”: This is the main constituent in photochemical air pollution. It is formed in the atmosphere by a chemical reaction of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight. In the upper atmosphere, ozone (O_3) shields the earth from harmful ultraviolet radiation; however, at ground level, it can cause harmful effects in humans and plants.
- “Particulate Matter”: Any dispersed matter, solid or liquid, in which the individual aggregates are larger than the single molecules in diameter, but smaller than 500 microns. Particulate matter includes dust, soot, smoke, and liquid droplets from sources such as factories, power plants, motor vehicles, construction activities, agricultural activities, and fires.
- “ PM_{10} ”: Particulate matter that is 10 microns or less in aerodynamic diameter. The EPA revised the NAAQS for particulate matter in 1987 to cover only PM_{10} because the smaller particles have a greater potential for respiratory health impacts.
- “SLAMS” State and Local Air Monitoring Stations. The Clean Air Act requires that every state establish a network of air monitoring stations for criteria pollutants, using requirements set by the EPA Office of Air Quality Planning and Standards.
- “Sulfur Oxides”: Sulfur oxides are colorless gases which include sulfur dioxide (SO_2), sulfur trioxide, their acids and the salts of their acids. Emissions of sulfur oxides are largely from sources that burn fossil fuels such as coal and oil. In the State of Hawaii, another source of sulfur oxide emissions is from the eruption of Kilauea Volcano on the Big Island.
- “Vog”: Vog is a local term used when volcanic gas and particles combine with air and sunlight to produce atmospheric haze.

Table 2-1 **State of Hawaii and Federal Ambient Air Quality Standards**

Air Pollutant	Averaging Time	Standards		
		Hawaii State Standard ^a ($\mu\text{g}/\text{m}^3$)	Federal Primary Standard ^b ($\mu\text{g}/\text{m}^3$)	Federal Secondary Standard ^c ($\mu\text{g}/\text{m}^3$)
Carbon Monoxide	1-hour	10,000	40,000	40,000
	8-hour	5,000	10,000	10,000
Nitrogen Dioxide	Annual (arithmetic)	70	100	100
PM ₁₀	24-hour	150	150	150
	Annual (arithmetic)	50	50	50
Ozone	1-hour	100 ^d	235	235
	8-hour	157 ^d	157	157
Sulfur Dioxide	3-hour	1,300	---	1,300
	24-hour	365	365	---
	Annual (arithmetic)	80	80	---
Lead	Calendar Quarter (arithmetic)	1.5	1.5	1.5
Hydrogen Sulfide	1-hour	35	—	---

^a Designated to protect public health and welfare and to prevent the significant deterioration of air quality. Source: HAR §11-59-1

^b Designated to prevent against adverse effects on public health. Source: 40CFR Part 50

^c Designated to prevent against adverse effects on public welfare, including effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials. Source: 40CFR Part 50

^d The 1-hour 100 $\mu\text{g}/\text{m}^3$ state standard was vacated and an 8-hour 157 $\mu\text{g}/\text{m}^3$ standard was adopted in September 2001

Section 3

SITE LOCATIONS AND DESCRIPTIONS

This section provides a description of the monitoring stations in the State of Hawaii. Table 3-1 lists the air pollutant(s) measured at each monitoring station, characterizes the area surrounding the station, and indicates the start dates for data collection. Table 3-2 identifies the type of sampler used to measure the concentration of each air pollutant. Figures 3-1, 3-2, 3-3 and 3-4 show the location of each monitoring station on the islands of Oahu, Kauai, Maui and Hawaii, respectively.

The following four subsections discuss each monitoring station in more detail.

A. ISLAND OF OAHU

1. Honolulu: Located atop the Department of Health (DOH) building (Kinau Hale) at 1250 Punchbowl Street in downtown Honolulu, this site is in a commercial, institutional, and residential area. It was established in April 1971 as a NAMS (PM_{10} , CO) and SLAMS station. The pollutants sampled at this site are PM_{10} , CO, and SO_2 .

2. Pearl City: Located atop the Leeward Medical Center at 860 Fourth Street, the area has a combination of commercial, industrial and residential units and is approximately nine and a half miles northwest of downtown Honolulu. This NAMS site was established in April 1971 and currently monitors for PM_{10} .

3. Waimanalo: Located within the Waimanalo Sewage Treatment Facility at 41-1069 Kalanianaʻole Highway, this site is in a sparsely populated rural and agricultural community. Waimanalo is on the windward (upwind) side of Oahu approximately ten miles east-northeast of downtown Honolulu. This site was established in July 1989 as a SLAMS site sampling for PM_{10} .

4. Sand Island: Located at the University of Hawaii's Anuenue Fisheries, the area is composed of light industrial, commercial, recreational, and harbor units and is approximately two miles southwest (typically downwind) of downtown Honolulu. This is a NAMS station that was established in February 1981 for the sampling of ozone.

5. Waikiki: Located at 2131 Kalakaua Avenue, Waikiki is a busy commercial and residential area with vehicular and pedestrian traffic. It is approximately three miles southeast of downtown Honolulu. The station was established in January 1981 as a NAMS site for the sampling of carbon monoxide.

6. Liliha: Located at Kauluwela Elementary School, 1486 Aala Street, this site is in a residential and commercial area near the heavily traveled H-1 freeway, approximately one and a quarter miles north of downtown Honolulu. This NAMS station was established in January 1984 and currently monitors for PM_{10} .

7. Makaiwa: Located at 92-670 Farrington Highway, this site is in a residential, industrial and agricultural area approximately twenty-five miles west of downtown Honolulu. This station is downwind and to the southeast of an electrical power plant. This site was established in July 1989 as a SLAMS station monitoring for SO₂.

8. West Beach: Located within the Ko'Olina Golf Course, this site is in a resort, recreational, residential, and agricultural area approximately 27 miles west of downtown Honolulu and 1.5 miles northwest of Campbell Industrial Park. This SLAMS station was established in February 1991 for the monitoring of NO₂, PM₁₀, CO and SO₂.

9. Kapolei: Located at 91-591 Kalaeloa Boulevard at the entrance to Campbell Industrial Park, this site is in a commercial, industrial, and residential area with nearby agricultural lands. It is approximately 25 miles west of downtown Honolulu and was established in February 1991 as a SLAMS site. Air pollutants measured at the site include NO₂, PM₁₀, CO and SO₂.

B. ISLAND OF KAUAI

Lihue: The Lihue monitoring station is located in downtown Lihue at the District Health Office, 3034 Umi Street. This site is in a commercial and residential area with nearby agricultural areas. It is a SLAMS station that was established in November 1972 and samples for PM₁₀.

C. ISLAND OF MAUI

1. Kihei: This station is currently located in Hale Piilani Park. Monitoring for particulates from sugarcane burning activities has been conducted in the Kihei area since 1996. In February 1999, the station was moved to Hale Piilani Park, which is in a residential and agricultural area, and monitors for PM₁₀.

2. Paia: This station is located in a residential area at 141 Baldwin Avenue. The site is downwind of several sugarcane fields and is just northeast of the HC&S Co. Paia Mill. This site was established in August 1996 as a special PM₁₀ sampling station for sugarcane burning activities.

D. ISLAND OF HAWAII

1. Kona: This station is located on the grounds of the Konawaena High School at 81-1043 Konawaena School Road in Kealahou, Hawaii. This special purpose site was established in April 1997 to monitor vog in the Kona area. The pollutant sampled at this site is SO₂.

2. Hilo: Established in March 1995, this station is located on the grounds of the Adult Rehabilitation Center of Hilo at 1099 Waianuenue Avenue to monitor vog. The pollutants sampled are SO_2 and PM_{10} .

3. Lava Tree: This station in Puna is located on the eastern border of the Lava Tree State Park in a residential-agricultural area near Nanawale Estates. It is approximately 1.4 miles northwest of the Puna Geothermal Venture power plant. The station was established in August 1993 and monitors for H_2S .

4. Puna E: Located in the Leilani Estates residential subdivision in Puna, it is approximately 3 miles south-southwest of the Puna Geothermal Venture power plant. Established in 1992, this station monitors for H_2S .

Table 3-1 State of Hawaii Air Monitoring Network

SITE	Station Type							
	PM ₁₀	CO	O ₃	SO ₂	NO ₂	H ₂ S	SITE DESCRIPTION	START DATE
OAHU								
HONOLULU	N	N	-	S	-	-	Center City / Commercial	April 1971
PEARL CITY	N	-	-	-	-	-	Suburban / Residential	April 1971
WAIMANALO	S	-	-	-	-	-	Rural / Agricultural	July 1989
SAND ISLAND	-	-	N	-	-	-	Center City	January 1981
WAIKIKI	-	N	-	-	-	-	Center City	January 1981
LILIHA	N	-	-	-	-	-	Center City	January 1984
MAKAIWA	-	-	-	S	-	-	Rural / Industrial	July 1989
WEST BEACH	S,C	S	-	S	S	-	Rural / Industrial	February 1991
KAPOLEI	S	S	-	S	S	-	Rural / Industrial	February 1991
KAUAI								
LIHUE	S	-	-	-	-	-	Center City / Commercial	October 1985
MAUI								
KIHEI	SS	-	-	-	-	-	Suburban / Residential	February 1999
PAIA	SS	-	-	-	-	-	Rural / Residential	August 1996
HAWAII								
KONA	-	-	-	SS	-	-	Suburban	April 1997
HILO	SS	-	-	SS	-	-	Center City	March 1995
LAVA TREE	-	-	-	-	-	SS	Rural / Agricultural	August 1993
PUNA E	-	-	-	-	-	SS	Rural / Agricultural	1992

N = (NAMS) National Air Monitoring Station

C = Collocated Site

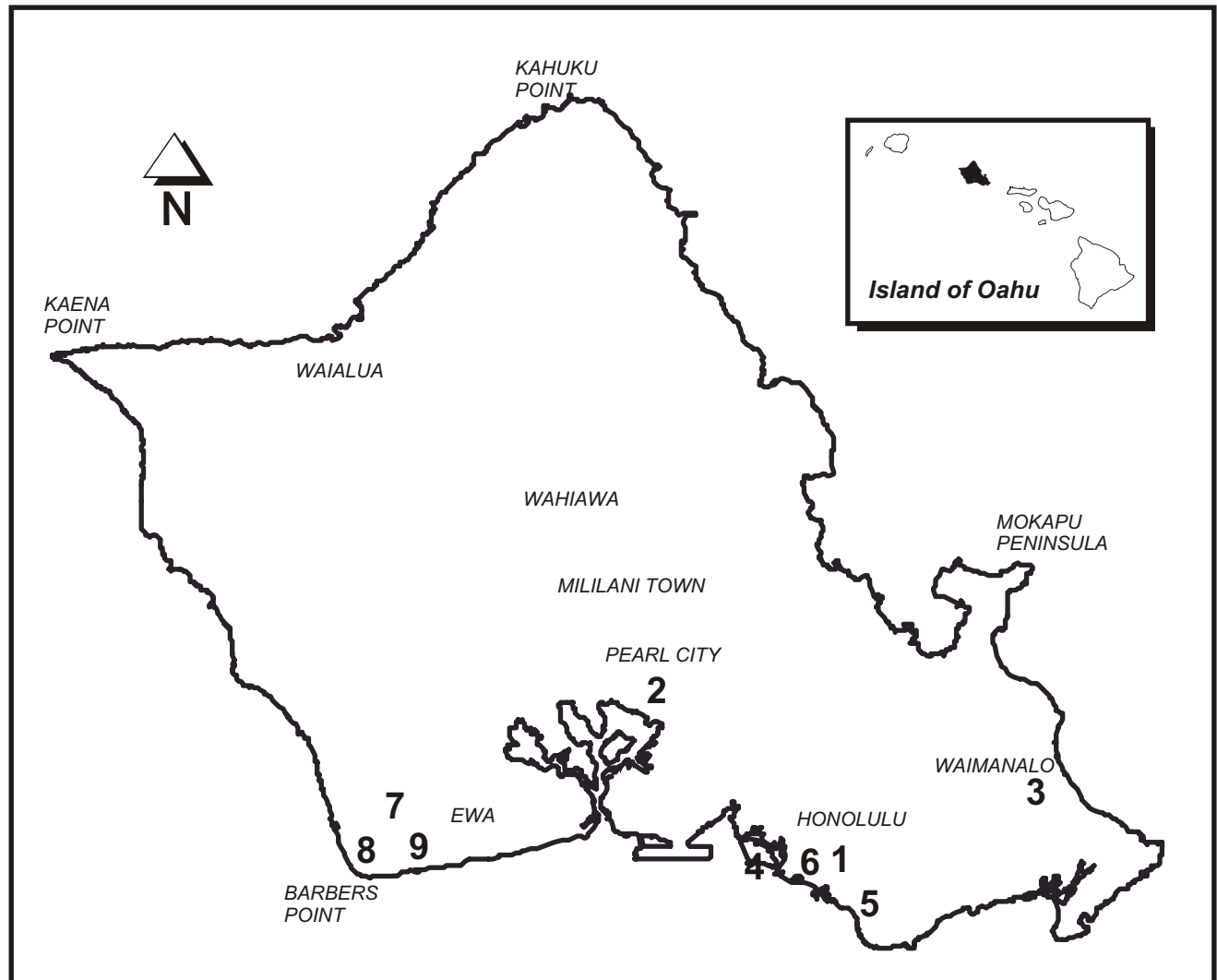
S = (SLAMS) State and Local Air Monitoring Stations

SS = Special Study (for monitoring of sugar cane burning, vog, or geothermal energy production)

Table 3-2 Sampling Equipment at Each Monitoring Station

Monitoring Station	Sampling Method						
	PM ₁₀ Continuous Ambient Particulate Monitor	PM ₁₀ Manual Ambient Particulate Monitor (1 in 6 day)	CO Continuous Gas Filter Correlation Analyzer	SO ₂ Continuous Pulsed Fluorescence Ambient Air Analyzer	O ₃ Continuous UV Photometric Analyzer	NO ₂ Continuous Chemiluminescence Analyzer	H ₂ S Continuous Pulsed Fluorescence Ambient Air Analyzer
OAHU							
Honolulu	X		X	X			
Pearl City	X						
Waimanalo		X					
Sand Island					X		
Waikiki			X				
Liliha	X						
Makaiwa				X			
West Beach		X	X	X		X	
Kapolei	X		X	X		X	
KAUAI							
Lihue		X					
MAUI							
Kihei	X						
Paia	X						
HAWAII							
Kona				X			
Hilo		X		X			
Lava Tree							X
Puna E							X

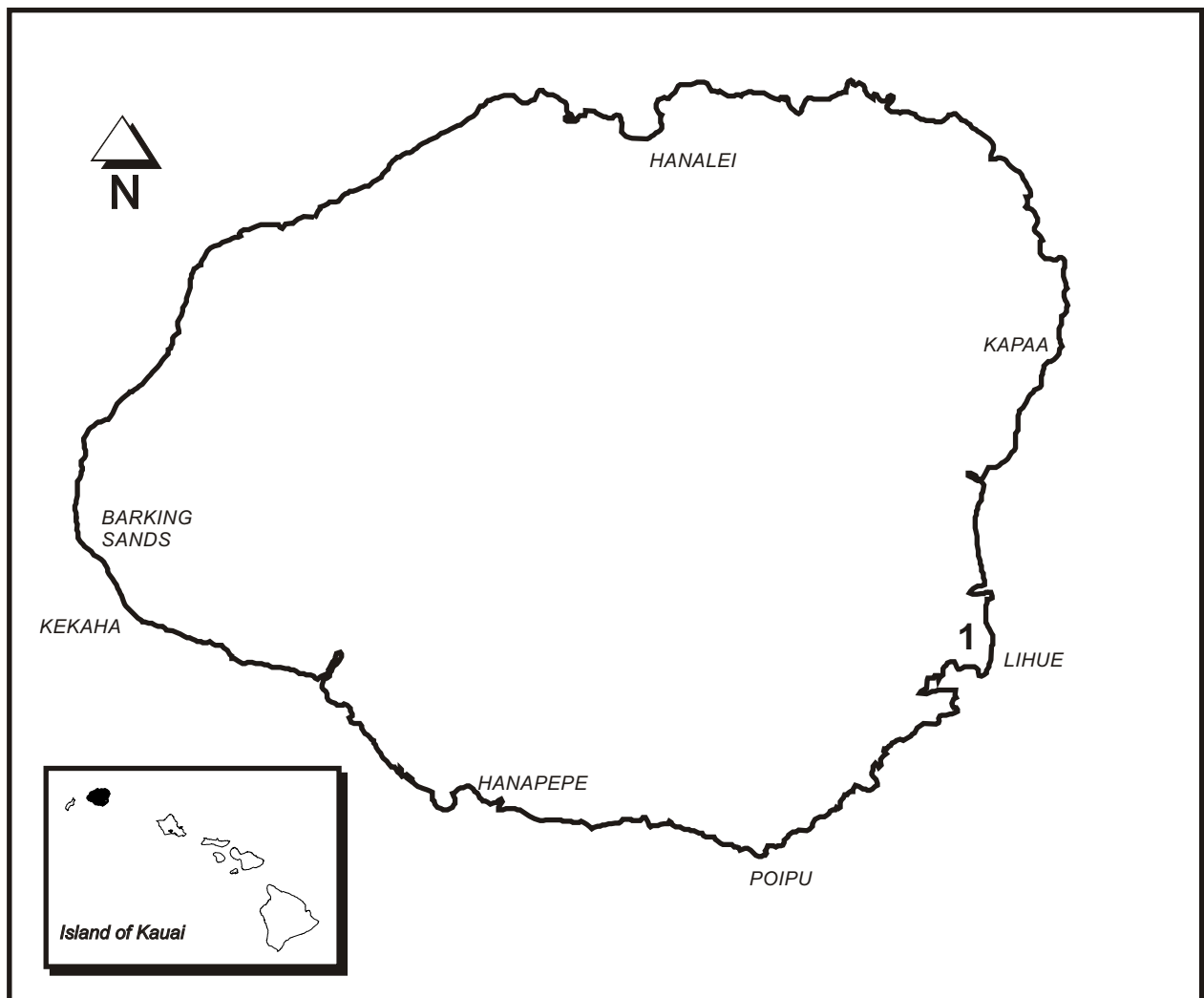
Figure 3-1 Island of Oahu: Location of Air Monitoring Stations



LEGEND

- 1 Honolulu (PM_{10} , SO_2 , CO)
- 2 Pearl City (PM_{10})
- 3 Waimanalo (PM_{10})
- 4 Sand Island (O_3)
- 5 Waikiki (CO)
- 6 Liliha (PM_{10})
- 7 Makaiwa (SO_2)
- 8 West Beach (PM_{10} , SO_2 , CO, NO_2)
- 9 Kapolei (PM_{10} , SO_2 , CO, NO_2)

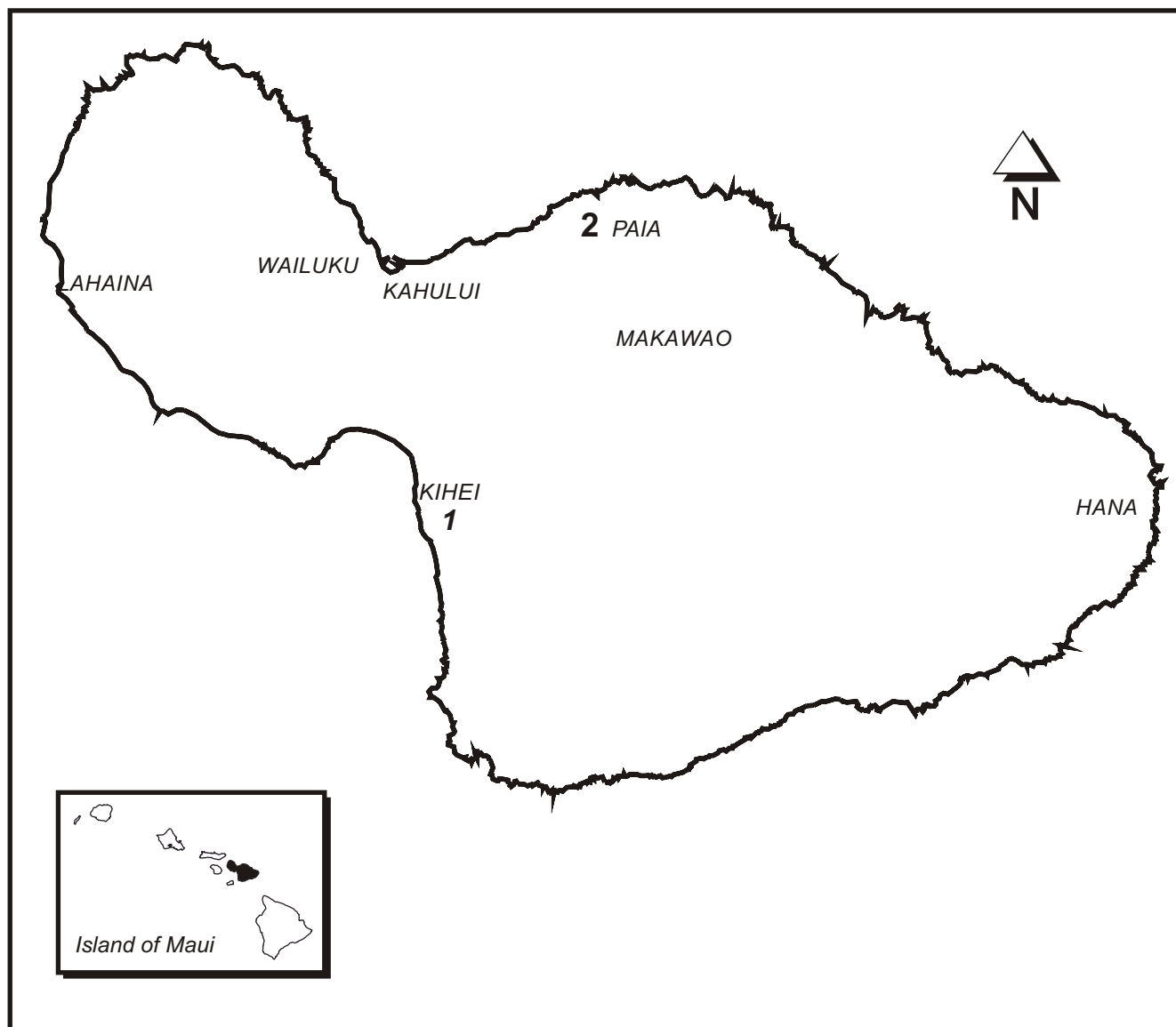
Figure 3-2 Island of Kauai: Location of Air Monitoring Station



LEGEND

1 Lihue (PM₁₀)

Figure 3-3 Island of Maui: Location of Air Monitoring Stations

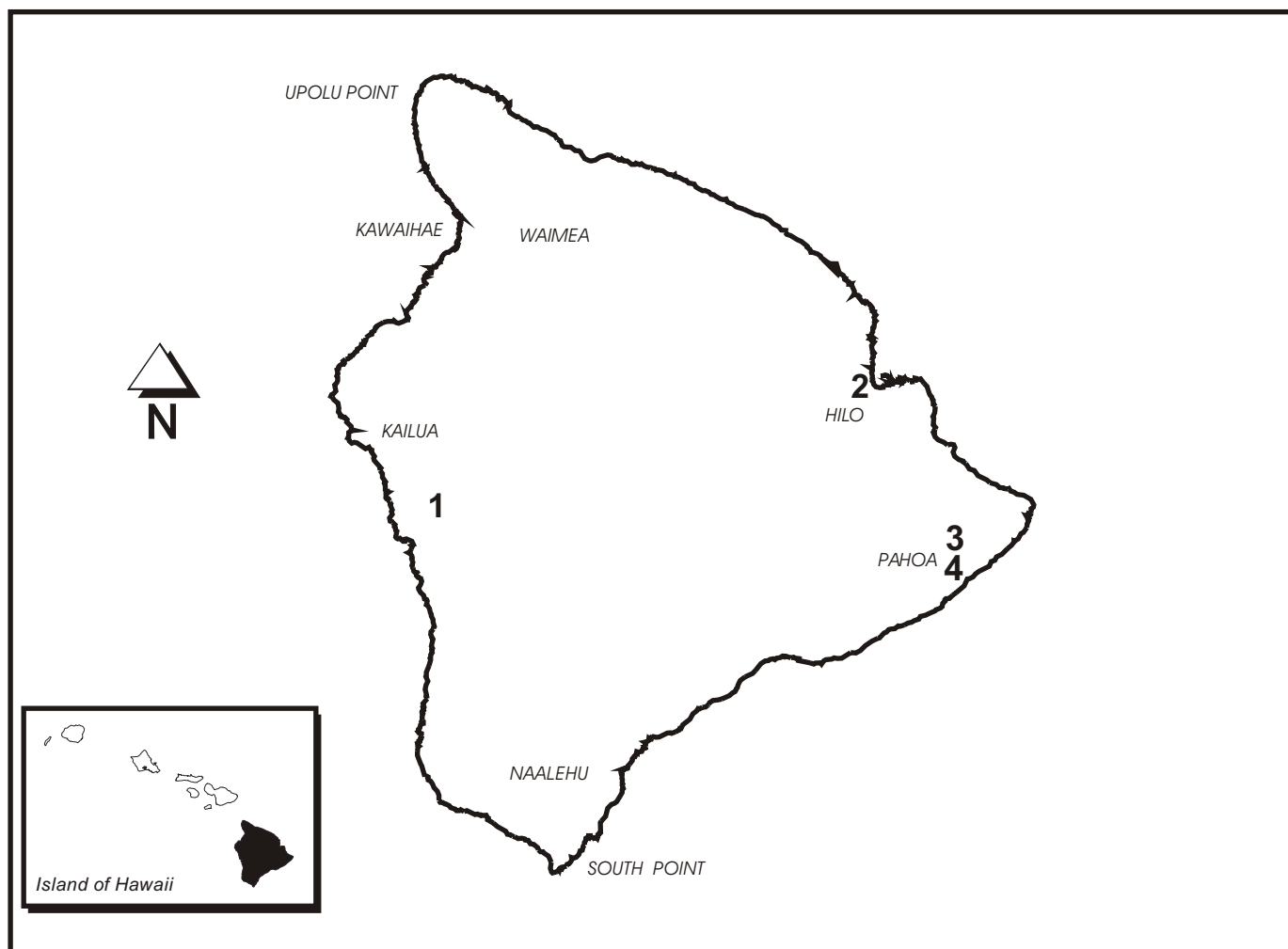


LEGEND

1 Kihei (PM_{10})

2 Paia (PM_{10})

Figure 3-4 Island of Hawaii: Location of Air Monitoring Stations



LEGEND

- 1 Kona (SO_2)
- 2 Hilo (PM_{10} , SO_2)
- 3 Lava Tree (H_2S)
- 4 Puna E (H_2S)

Section 4

2001 AIR QUALITY DATA

Hawaii enjoys some of the best air quality in the nation and, being an island state, is not impacted by pollution from neighboring states. However, as in any metropolitan area, there is some air pollution from various industrial and mobile sources in addition to agricultural and natural sources. The Department of Health, Clean Air Branch, has the responsibility for monitoring, protecting and enhancing the state's air quality and regulates and monitors pollution sources to ensure that the levels of criteria pollutants remain well below the state and federal air quality standards.

The following tables summarize the pollutant concentrations measured at each monitoring station. Tables 4-1 through 4-7 are annual summaries grouped by pollutant and provide the number of occurrences exceeding the NAAQS. There is no federal ambient air quality standard for H₂S, and Table 4-8 provides the number of occurrences exceeding the state standard.

The annual statistics provided in tables 4-1 through 4-8 are the highest and second highest $\mu\text{g}/\text{m}^3$ values recorded in the year for the averaging period and the annual means, which is the arithmetic mean of all valid hours recorded in the year. The possible periods is the total number of possible sampling periods in the year for the averaging time, and valid periods is the total number of sampling periods after data validation.

Tables 4-9 through 4-16 are monthly summaries of the range and average of each pollutant for each averaging period. The range is the lowest and highest $\mu\text{g}/\text{m}^3$ values recorded in the month for the averaging period and the average is the arithmetic mean of all hours recorded in the month. The highest value recorded in the year for each site is in bold.

In the year 2001, the State of Hawaii was in attainment for all federal ambient air quality standards.

Table 4-1 Annual Summary of 24-Hour PM₁₀

	-----Annual Statistics-----			-----24-hour Occurrences Greater than 150 µg/m ³ -----													Possible Periods	Valid Periods
	--- Max Hr---		--Annual Means--	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
	1 st High	2 nd High																
OAHU																		
Honolulu	63	33	16	0	0	0	0	0	0	0	0	0	0	0	0	365	365	
Liliha	116	35	16	0	0	0	0	0	0	0	0	0	0	0	0	365	352	
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Waimanalo ^a	39	32	17	0	0	0	0	0	0	0	0	0	0	0	0	61	55	
Pearl City	167 ^b	100	15	1 ^b	0	0	0	0	0	0	0	0	0	0	0	365	354	
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Kapolei	121	104	19	0	0	0	0	0	0	0	0	0	0	0	0	365	352	
West Beach ^a	21	20	13	0	0	0	0	0	0	0	0	0	0	0	0	61	55	
KAUAI																		
Lihue ^a	31	29	17	0	0	0	0	0	0	0	0	0	0	0	0	61	57	
MAUI																		
Kihei	93	91	23	0	0	0	0	0	0	0	0	0	0	0	0	365	341	
Paia	83	80	20	0	0	0	0	0	0	0	0	0	0	0	0	365	337	
HAWAII																		
Kona	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	-	-	
Hilo ^a	20	19	12	0	0	0	0	0	0	0	0	0	0	0	0	61	55	
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

^a PM₁₀ sampling once every 6th day

^b Highest value, measured by a continuous method, occurred on 1/1/01, probably due to New Year's fireworks

Table 4-2 Annual Summary of 1-Hour Carbon Monoxide

[illegible]

Table 4-3 Annual Summary of 8-Hour Carbon Monoxide

[illegible]

Table 4-4 Annual Summary of 1-Hour Ozone

[illegible]

Table 4-5 Annual Summary of 3-Hour Sulfur Dioxide

[illegible]

Table 4-6 Annual Summary of 24-Hour Sulfur Dioxide

[illegible]

Table 4-7 Annual Summary of Nitrogen Dioxide

[illegible]

Table 4-8 Annual Summary of 1-Hour Hydrogen Sulfide

	-----Annual Statistics-----			-----1-hour Occurrences Greater than 35 µg/m³-----													Possible Periods	Valid Periods
	--- Max Hr---		-Annual Means-	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
	1 st High	2 nd High														All Hours		
OAHU																		
Honolulu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																		
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																		
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																		
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	8	7	3	0	0	0	0	0	0	0	0	0	0	0	0	8760	7983	
Puna E	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	8760	8316	

Table 4-9 Monthly Summary of 24-Hour PM₁₀ (µg/m³)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	9-25	11-31	8-22	11-33	7-19	9-22	8-24	10-20	9-18	9-27	10-28	9- 63
	Average	15	18	16	19	13	13	15	14	13	16	16	18
Liliha	Range	10-32	13-31	7-22	11-35	8-21	11-21	9-25	9-18	9-17	11-24	11-24	12- 116
	Average	16	18	16	19	14	14	14	14	12	15	15	22
Pearl City	Range	9- 167	12-28	8-23	10-33	7-19	9-20	5-24	7-16	9-20	9-22	11-21	11-100
	Average	20	18	16	18	13	13	14	12	12	14	14	19
Waimanalo ^a	Range	10-15	14-22	13-19	14-24	9-21	11-19	14-21	11-21	16-22	10-25	8-20	15- 39
	Average	12	18	17	20	16	14	18	17	19	17	13	27
Kapolei	Range	8-31	10-26	8-33	11-40	8-22	9-21	8-25	9-26	10-20	14- 121	10-104	9-57
	Average	17	17	16	17	14	13	14	14	14	45	32	20
West Beach ^a	Range	11-20	12-15	10-18	9-15	10-15	8-17	10-12	7-15	10-16	10-17	9-15	14- 21
	Average	14	14	14	13	12	11	11	11	12	12	13	18
Lihue ^a	Range	8- 31	15-19	12-20	16-21	13-20	12-24	13-20	12-22	10-18	13-27	8-16	17-29
	Average	15	17	17	18	17	15	17	16	16	19	13	23
Kihei	Range	7-28	8-36	9-29	9-40	10-91	14-63	14-88	12- 93	10-36	10-44	8-22	7-41
	Average	16	18	18	25	24	27	33	30	22	22	16	19
Paia	Range	11-33	12-35	13-63	13-54	10- 83	10-26	9-33	9-21	10-19	10-29	9-32	11-46
	Average	20	22	22	23	31	16	18	14	14	15	18	19
Hilo ^a	Range	6-16	8-19	8-18	8-13	9- 20	10-16	9-14	4-16	9-16	9-11	10-11	11-17
	Average	12	11	12	11	12	13	10	11	12	10	10	14

^a Sampling is once every 6th day

Table 4-10 Monthly Summary of 1-Hour Carbon Monoxide (µg/m³)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	0-2850	570-3534	342-2622	570-1482	0-1254	114-1140	456- 5244	228-2052	228-1710	228-3078	456-3648	570-2280
	Average	747	1013	791	806	320	405	733	648	731	562	803	880
Waikiki	Range	342-2508	342-2280	456-2394	456-1596	114- 5016	570-1824	570-1710	684-2052	342-1596	456-2736	570-3420	570-2622
	Average	817	873	849	780	934	927	920	983	734	790	978	980
Kapolei	Range	342-1938	228-1938	0-1710	114-1824	342-1254 632	342-1254	228-1710	114- 2280	0-1140	228-1368	228-1596	228-1140
	Average	651	770	763	616	590	590	554	560	392	571	507	557
West Beach	Range	0-570	114- 1026	114-684	114-456	114-456	114-342	114-456	0-456	0-342	0-684	0-912	0-570
	Average	119	243	277	261	240	221	230	235	131	185	196	147

Table 4-11 Monthly Summary of 8-Hour Carbon Monoxide (µg/m³)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	470-1197	599-1439	356-1425	599-1154	114-926	143-926	499- 2209	314-1226	271-1040	271-1340	485-1368	613-1340
	Average	747	1013	791	806	320	405	733	648	731	562	803	880
Waikiki	Range	413-1743	442-1425	499-1496	542-1211	599- 2921	698-1368	698-1297	684-1368	470-1254	542-1354	627-1781	698-1753
	Average	817	873	849	780	934	927	920	983	734	790	978	980
Kapolei	Range	356-1069	356- 1596	33-1283	200-1040	456-912	342-855	228-1040	200-1340	0-765	228-812	271-855	328-812
	Average	651	770	763	616	632	590	554	560	392	571	507	557
West Beach	Range	0-314	171-399	195-413	128-385	143-342	143-242	214-285	43-342	57-228	0-285	71- 456	114-242
	Average	119	243	277	261	240	221	230	235	131	185	196	147

Table 4-12 Monthly Summary of 1-Hour Ozone ($\mu\text{g}/\text{m}^3$)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Sand Island	Range	0-78	2-90	2- 104	4-86	2-72	2-55	2-53	0-49	2-55	2-76	2-80	2-80
	Average	36	40	52	54	35	26	23	22	29	38	33	46

Table 4-13 Monthly Summary of 3-Hour Sulfur Dioxide ($\mu\text{g}/\text{m}^3$)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	0-7	0-1	0-6	0-3	0-3	0-1	0-30	0-13	0-10	0-14	0-17	0- 45
	Average	0.1	0	1	0.2	0.2	0	4	2	5	3	0.6	4
Makaiwa	Range	3-38	3-30	3-20	3-15	1- 61	3-11	3-52	3-32	3-58	3-24	3-27	0-28
	Average	4	5	4	3	4	3	4	4	5	5	6	2
Kapolei	Range	0-15	0-5	0- 24	0-15	0-5	3-5	3-8	0-7	0-5	0-10	0-4	2-9
	Average	2	1	1	2	3	3	3	2	1	3	1	3
West Beach	Range	0-3	0- 12	0-3	0-3	0-3	0-1	0-3	0-3	0-3	0-5	0-6	0-2
	Average	0.1	1	0.1	0	0	0	0.1	0.1	0	0.1	0.4	0
Kona	Range	0-33	5-30	5-37	5-28	6- 38	3-24	3-15	3-13	3-17	4-21	5-20	5-24
	Average	7	8	9	9	11	12	4	4	6	7	8	8
Hilo	Range	0-348	2-170	3- 461	3-21	3-186	3-12	3-10	3-69	3-183	3-110	3-181	3-272
	Average	8	9	13	3	6	3	3	4	5	4	10	8

Table 4-14 Monthly Summary of 24-Hour Sulfur Dioxide ($\mu\text{g}/\text{m}^3$)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	0-1	0-0.1	0-3	0-2	0-1	0-0.1	0- 25	0-11	0-10	0-6	0-3	1-20
	Average	0.1	0	1	0.2	0.2	0	4	2	5	3	0.6	4
Makaiwa	Range	3-10	3-11	3-8	3-7	3- 18	3-5	3-14	3-9	3-13	3-7	4-10	0-9
	Average	4	5	4	3	4	3	4	4	5	5	6	2
Kapolei	Range	0.2- 7	0-2	0-6	1-4	1-3	3-3	3-5	0.1-5	0.1-2	0-6	0-3	3-4
	Average	2	1	1	2	3	3	3	2	1	3	1	3
West Beach	Range	0-1	0- 5	0-1	0-0.5	0-1	0-0.1	0-0.5	0-1	0-0.3	0-1	0-3	0-0.2
	Average	0.1	1	0.1	0	0	0	0.1	0.1	0	0.1	0.4	0
Kona	Range	1-14	5-17	5-15	6-14	7- 22	3-17	3-7	3-7	4-9	5-12	5-13	6-13
	Average	7	8	9	9	11	12	4	4	6	7	8	8
Hilo	Range	1- 101	3-55	3-89	3-5	3-50	3-5	3-6	3-16	3-38	3-30	3-73	3-46
	Average	8	9	13	3	6	3	3	4	5	4	10	8

Table 4-15 Monthly Summary of 24-Hour Nitrogen Dioxide ($\mu\text{g}/\text{m}^3$) ^a

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Kapolei	Range	4-25	4-17	5-15	4-10	5-13	4-9	4-9	3-9	5-11	5-18	5-15	3-18
	Average	12	10	9	7	8	7	6	7	8	9	10	9
West Beach	Range	5-16	3-20	4-11	3-12	3-13	3-8	3-8	3-9	2-10	3-11	4-15	2-13
	Average	9	8	7	6	6	5	5	6	5	6	8	8

^a There is no 24-hour state or federal standard for nitrogen dioxide

Table 4-16 Monthly Summary of 1-Hour Hydrogen Sulfide ($\mu\text{g}/\text{m}^3$)

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Lava Tree	Range	1-3	1-3	1- 8	1-3	3-4	0-3	3-4	3-4	3-4	3-4	4-6	4-6
	Average	1	2	2	3	3	3	3	3	4	4	4	4
Puna E	Range	0-0	0-0	0-1	0-0	0-1	0-1	0- 3	0-1	0-1	0-3	0-3	0-3
	Average	0	0	0	0	0.3	1	1	0.4	0.2	1	1	1

Section 5 **AMBIENT AIR QUALITY TRENDS**

The following graphs illustrate 5-year trends for PM₁₀, ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide from 1997 to 2001.

The graphs for PM₁₀, sulfur dioxide and nitrogen dioxide (figures 5-1, 5-2, 5-5 and 5-6, respectively) represent the annual averages for each year and for each station that monitors for that pollutant. Annual averages are derived by calculating the arithmetic mean of all valid hours recorded in the year. Included in the graphs are the state and federal annual standard(s).

The graphs for 1-hour ozone and 1-hour carbon monoxide (figures 5-3 and 5-4, respectively) represent the average of the daily maximum 1-hour values recorded in the year. These values are obtained by taking the highest recorded 1-hour value for each day then calculating the arithmetic mean of all those hours to arrive at the annual maximum average. Ozone and carbon monoxide do not have state or federal annual standards, however, included in the graphs are the 1-hour standards.

Figure 5-1 Island of Oahu: PM₁₀ Annual Average 1997 - 2001

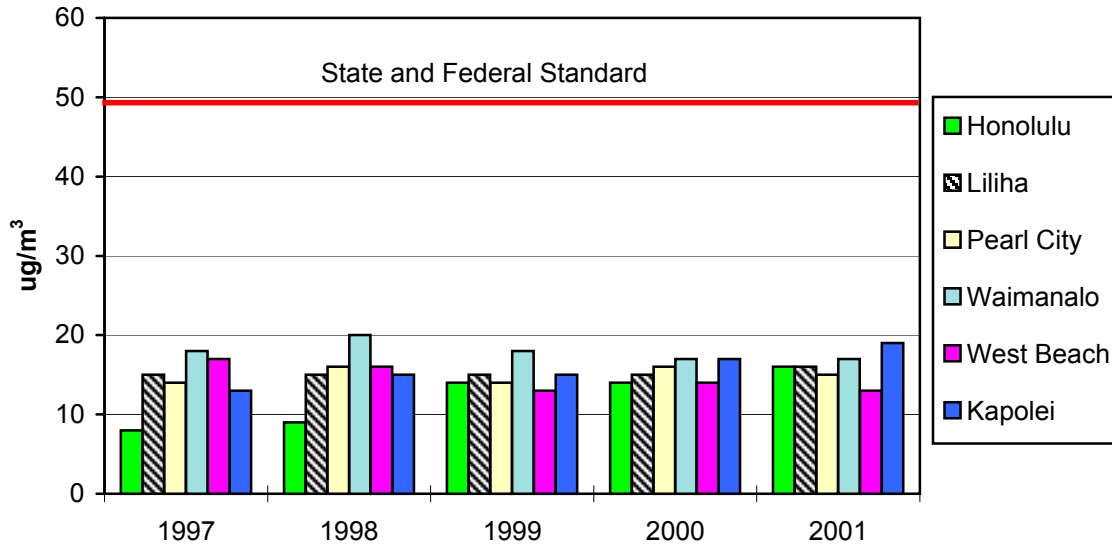
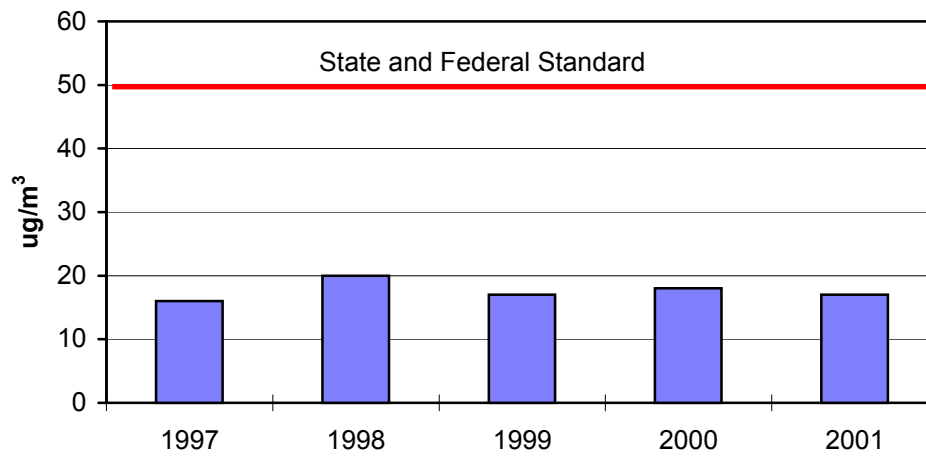
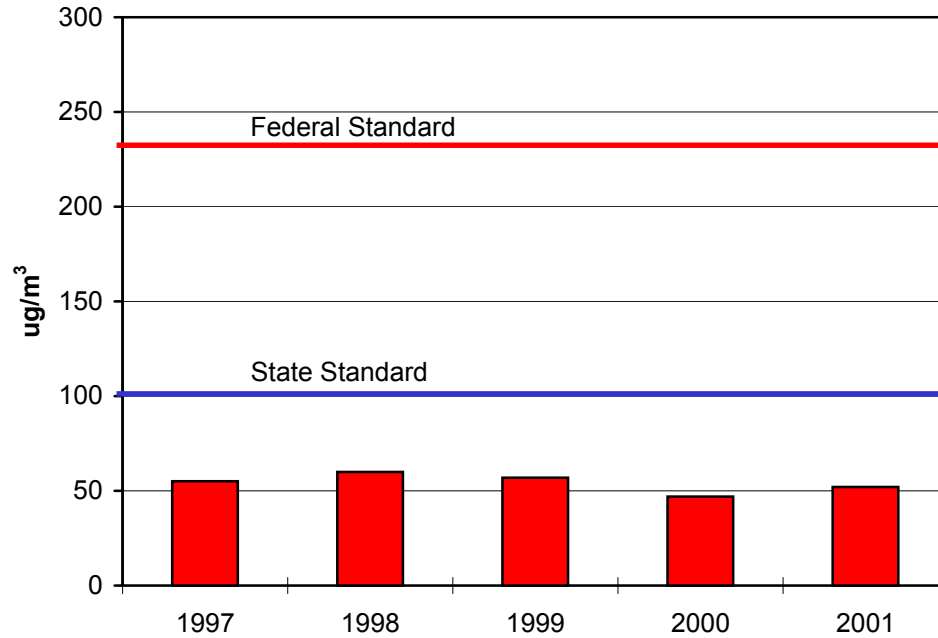


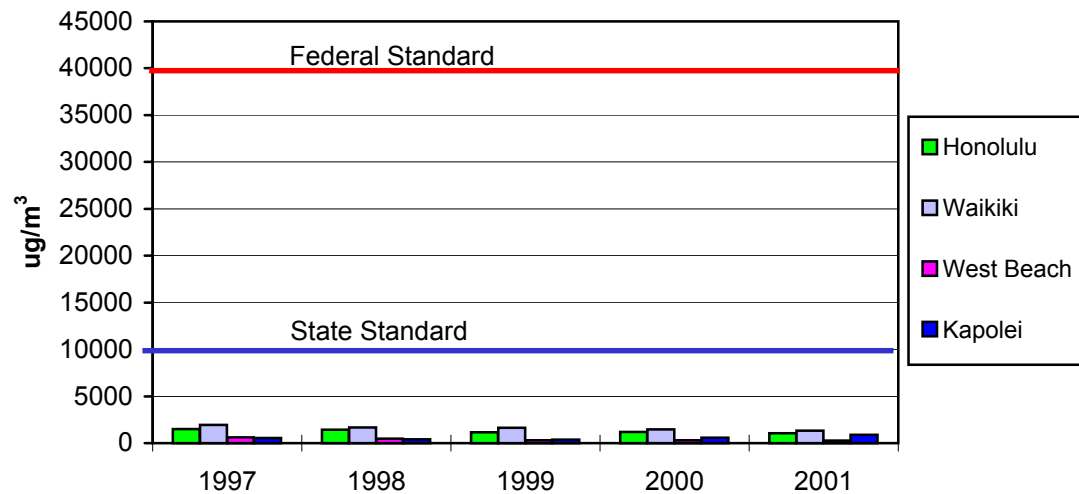
Figure 5-2 Island of Kauai: PM₁₀ Annual Average 1997 - 2001



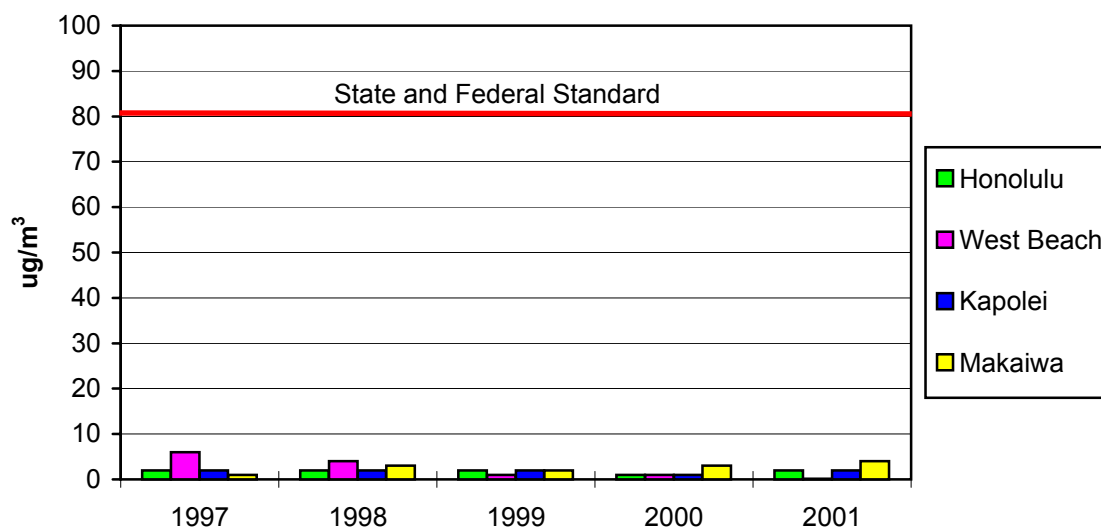
**Figure 5-3 Annual Average of Daily Maximum
1-Hour Ozone 1997 - 2001**



**Figure 5-4 Annual Average of Daily Maximum
1-Hour Carbon Monoxide 1997 - 2001**



**Figure 5-5 Annual Average Sulfur Dioxide
1997 - 2001**



**Figure 5-6 Annual Average Nitrogen Dioxide
1997 - 2001**

